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1965

1965

INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

APPOINTED UNDER A CONVENTION
BETWEEN CANADA AND THE UNITED STATES FOR THE
PROTECTION, PRESERVATION AND EXTENSION OF
THE SOCKEYE AND PINK SALMON FISHERIES IN
THE FRASER RIVER SYSTEM

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ANNUAL REPORT

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COMMISSIONERS

SENATOR THOMAS REID
A. J. WHITMORE
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CLARENCE F. PAUTZKE
GEORGE C. STARLUND

NEW WESTMINSTER
CANADA
1966

INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

MEMBERS
AND PERIOD OF SERVICE
SINCE THE INCEPTION OF THE COMMISSION
IN 1937

CANADA

William A. Found	1937-1939
A. L. Hager	1937-1948
Senator Thomas Reid	1937-
A. J. Whitmore	1939-
Olof Hanson	1948-1952
H. R. MacMillan, C.B.E., D.Sc.	1952-1956
F. D. Mathers	1956-1960
W. R. Hourston	1960-

UNITED STATES

Edward W. Allen	1937-1951 1957-1957
B. M. Brennan	1937-1942
Charles E. Jackson	1937-1946
Fred J. Foster	1943-1947
Milo Moore	1946-1949 1957-1961
Albert M. Day	1947-1954
Alvin Anderson	1949-1950
Robert J. Schoettler	1951-1957
Elton B. Jones	1951-1957
Arnie J. Suomela	1954-1961
DeWitt Gilbert	1957-
Clarence F. Pautzke	1961-
George C. Starlund	1961-

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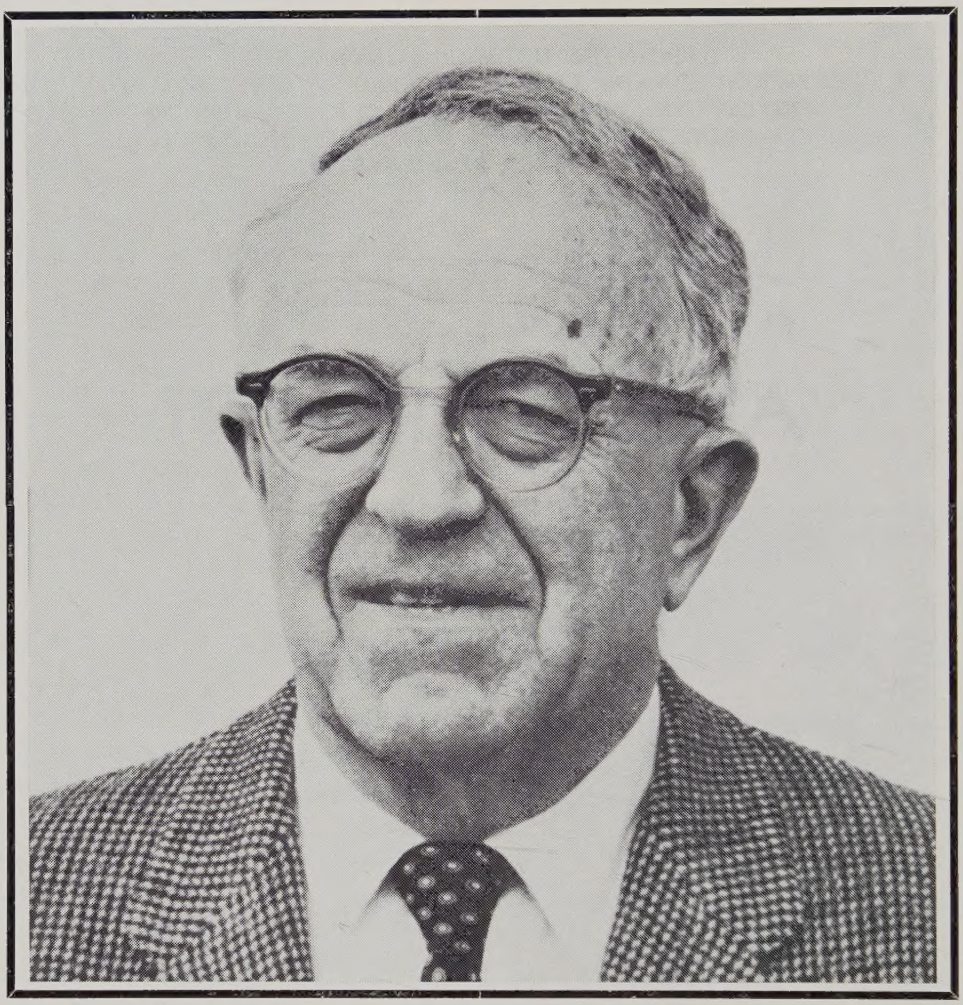
DIRECTOR OF INVESTIGATIONS
LOYD A. ROYAL

NEW WESTMINSTER
CANADA
1966



DR. WILLIAM FRANCIS THOMPSON

Former Director of Investigations of the International Pacific Salmon Fisheries Commission who passed away in November, 1965. Dr. Thompson, as the Commission's first Director (1937-1943), laid the remarkable scientific foundation upon which the Commission's work is based to this time.

REPORT OF THE
INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION
FOR THE YEAR 1965

The elementary principle of salmon management involves the regulation of the fishery to provide for spawning escapement. This principle has been expanded considerably in recent years by the International Pacific Salmon Fisheries Commission to include identification of individual populations present in the fishery by time and place. Thus, each population making up the season's run is considered in respect to allowable catch and escapement requirements when fishing regulations are designed.

The numerical size of escapements required by individual populations of Fraser River sockeye and pink salmon has been approximated by field surveys and prototype experimentation. Numbers of spawning fish desired in each area are now determined either by the physical capacity of the spawning ground or the rearing capability of the lake. The natural variation in run size within a quadrennial cycle, as recorded during the years prior to and during development of the fishery, has been considered a prerequisite to maximum production of sockeye. As nearly as is practical, individual sockeye escapements are controlled to fit the historical pattern of productivity in each of the four cycle years. A large escapement is provided in the year of the dominant run, a reduced number of fish in the year of sub-dominant run and lesser numbers of fish are permitted to escape under normal circumstances in the two "off-years".

The sophistication of salmon management through scientific endeavour resulted in a rapid improvement in the size of Fraser River sockeye runs from 1949 to 1961. Since 1957, the brood year for the 1961 run, the numbers of young fish emigrating from the Fraser River have tended to increase but the returning adult runs have not. Adult production from Fraser River pink salmon escapements have also been light in recent years even though fry production has been satisfactory in most cases, varying in proportion to parental escapement except when affected adversely by floods.

When substantial escapements of salmon produce large numbers of young fish without providing corresponding increases in the returning adult runs, the economic impact on the fishing industry is serious. From the standpoint of industry, an escapement is an investment for the future, the larger the escapement the larger the investment. If returns from this investment continue to be poor for several years, the question arises as to why this has occurred. Was the investment too large and was it handled wisely? Unless these questions can be answered with facts, management formulae, highly developed though they may be, remain incomplete.

If production of young fish from an escapement is satisfactory, the prime purpose of management appears to have been accomplished. This is not enough, however, if these fish fail to survive to maturity. A categorical answer that the young fish did not survive their oceanic existence may be a logical explanation, but not necessarily a true one. In fact, extensive studies by the Commission relating

survival to various aspects of freshwater and estuarial environment of the Fraser River indicate that the ocean environment usually is not a major factor determining survival of Fraser River sockeye and pink salmon populations.

Sensitivity of salmon to variations in the freshwater and estuarial environment never has been measured satisfactorily. Even a casual study indicates that sensitivity to the environment varies between races of a particular species as well as between species. This fact has been evident throughout the history of artificial propagation where arbitrary environments have been imposed on particular populations. Some of the populations have reacted favorably; others have not.

Using environmental factors in fresh water as a guide, the Commission has predicted the size of adult Fraser River sockeye runs with considerable accuracy well in advance of the fishing season for over a decade. Poor runs have been correctly predicted even when numbers of seaward migrating yearling sockeye have been of considerable magnitude. Moderately good runs have been predicted on the basis of relatively small migrations of young fish. Prediction of Fraser River pink salmon runs based on estuarial environment studies has failed once in the past five cycles, indicating the possibility either that oceanic factors can intervene occasionally in determining the final survival rate of a pink salmon population or that the existing environmental formula for predicting run size is not always complete.

In studies relating environmental conditions to survival, the Commission has found that mean water temperatures during spawning and incubation of pink salmon apparently are related, not to success of reproduction, but to subsequent fry survival. The Commission also has found that a few degrees variation in the mean water temperature during estuarial existence in the extensive area of mixing of the Fraser River with the inland sea, may determine the ability of fingerling pink salmon to survive at this period of development. In the case of sockeye, a direct relationship has been established between the Fraser River flow at the time yearling migrants enter the estuary and the proportion of these fish returning two years later. In addition, there appear to be other environmental factors governing survival of sockeye smolts but further study is required before this information may be used with confidence in predicting adult survival.

How these factors influence survival are far from being understood. Limited data indicate the possibility that there may be an improper functioning of the endocrine system which might interfere with the delicate transition of young fish from fresh to salt water. Parasites, predators and pathogenic organisms may also influence survival during the critical period. Weakened condition of the fish, brought about by an inadequate food supply, may lead to subsequent mortality. It is obvious that control of these aspects of the environment might be difficult, if not impossible; why then is it necessary to understand how these environmental factors control the survival of young salmon.

No fisheries management agency will have the complete confidence of the industry or the public unless it can provide detailed explanations for the success or failure of the runs. Nor can any problem be considered unsolvable until it is fully defined and clearly understood. Since millions of dollars are at stake each

year in whether a Fraser River sockeye or pink salmon run is large or small, artificial control of the environment may not be beyond economic consideration. Once the requirements of environmental control are clearly defined they may be assessed in relation to the benefits to be derived if such control is possible.

Logging, water diversion, pollution and high dams all contribute to environmental change. Their collective and perhaps individual development may well be disastrous to the salmon resource unless the environmental tolerance limits of all races of salmon are defined and those limits maintained. It has been estimated that over $200,000,000 have been invested in fish facilities related to the construction of hydro-electric dams on the Columbia River. Yet recent investigation by an experienced and capable fisheries biologist has indicated cause for apprehension concerning survival of Upper Columbia River salmon runs. His conclusions are quoted as follows:*

> "In view of the high mortality that may be imposed on the young salmon in passing the Columbia River dams under controlled river storage and future power operations, there is good reason to be apprehensive about the survival of the downstream migrants from the upper reaches of the river. If this was the only mortality that may be imposed upon them while enroute to the ocean, it would be possible to eliminate a large part of it by the installation of additional, though costly, fish protective facilities at the dams. This is not the case however, for there are environmental hazards developing in the reservoirs that are equally as deleterious to the migrant salmon and which may become more so with the aging of the impoundmented river. Unfortunately little can be done to eliminate these hazards, since they are the result of permanent major changes in the physical and biological complex of the river. Hence it appears inadvisable to make further capital investment in fish protective facilities at the upriver dams until an assessment is made of the effect of the complete impoundment of the river on the survival and habits of the young salmon."

Information collected by the Commission showed that incubating sockeye and pink salmon embryos exhibited retarded growth when subjected to extremely dilute concentrations of neutralized bleach waste from kraft pulp mills. These concentrations were approximately one-twentieth of those previously found to be toxic to sockeye fingerlings and these findings have led to improvement in the waste treatment facilities required of pulp mills currently operating or being constructed on the Fraser River watershed. It is evident that protection of the fisheries and the proper design of artificial aids for increasing the production of young sockeye and pink salmon depends on knowledge of the environmental conditions required to produce fish capable of surviving to maturity. The same is true in the transplantation of a race to a barren area of the watershed, which is one of the requirements in the Commission's terms of reference.

Establishment of any statistical relationship between the environment and survival requires the accumulation of extensive data. The Commission's program has included the collection of such information and this has been greatly augmented

* Davidson, F. A., 1965. The Survival of the Downstream Migrant Salmon at the Power Dams and in Their Reservoirs on the Columbia River. Public Utility District of Grant County, Washington. November, 1965.

by data from other agencies. The value of this information has been demonstrated in many ways, including successful prediction of run size and determination of water temperature levels involved in the recent disastrous mortalities in sockeye escapements, particularly those to the Horsefly River.

The function of environment in controlling survival during the freshwater and estuarial life of Fraser River sockeye and pink salmon is under intensive study by this Commission so that variations in run size can be fully understood. At the same time, information will become increasingly available for protecting and extending the great resource represented by these two species of Fraser River salmon.

COMMISSION MEETINGS

The International Pacific Salmon Fisheries Commission held twenty formal meetings during 1965 with the approved minutes of the meetings being submitted to the Governments of Canada and the United States. The first meeting of the year was held on January 28 and 29, with Mr. DeWitt Gilbert serving as Chairman and Senator Thomas Reid as Vice-Chairman and Secretary. Developments in forest utilization and log driving in the Fraser River watershed were reviewed in conjunction with other matters pertaining to administration of the Commission. On January 29 the Commission met with its Advisory Committee composed of the following members:

Canada	*United States*
Peter Jenewein Gill Net Fishermen	Vernon Blake Gill Net Fishermen
Charles Clarke Purse Seine Fishermen	N. Mladinich Purse Seine Fishermen
Richard Nelson Salmon Processors	John Plancich Salmon Processors
H. Stavenes Purse Seine Crew Members	John Brown Reef Net Fishermen
R. H. Stanton Troll Fishermen	Fred Bullock Troll Fishermen
J. C. Murray (absent) Sport Fishermen	Howard Gray Sport Fishermen

The tentative recommendations for regulatory control of the 1965 sockeye and pink salmon fishery in Convention waters, as submitted to the Advisory Committee by the Commission on December 11, 1964, were reviewed and certain revisions made on the basis of the representations of the Advisory Committee.

On May 20 and 21, 1965, the Commission met in executive session for a review of general operating problems. Mr. Thor C. Tollefson, the new Director of Fisheries for the State of Washington, was welcomed as an observer pending his appointment to the Commission. Staff reports were presented on the following subjects: 1. The effects of neutralized kraft pulp mill waste on pink and sockeye salmon at various stages of their life history from egg to adult, 2. The effect of variations in light, velocity and dissolved oxygen during the incubation of sockeye eggs and alevins, 3. Progress achieved in studies of columnaris infection in sockeye, 4. A proposed study of the effects of log driving on the spawning and incubation

of sockeye salmon related particularly to the Stellako River. The Commission budget covering operations and capital projects for the 1966-1967 fiscal year was approved for submission to the two governments. Mr. R. H. Wright of Victoria was appointed to represent Canadian Sport Fishermen on the Commission's Advisory Committee.

The Commission met in executive session on June 25, 1965, when the studies pertaining to current log driving on the Stellako River were reviewed and a film was shown of log drives on both the Stellako and Tachie Rivers. The annual catches of sockeye taken for food by native Indians throughout the Fraser River watershed were presented and note was taken of the substantial increase in percentage of the gross escapement harvested in recent years. Regulatory problems involved in the current fishing season were discussed and test fishing plans considered for the measurement of run size.

Fourteen meetings of the Commission were required between July 5 and October 4, 1965, inclusive, to achieve, by adjustment of fishing regulations, the desired escapement and equitable division of the allowable catch of sockeye and pink salmon. Meetings on July 26 and August 20, 1965, were held with the Advisory Committee.

The Commission again met in executive session on November 15 and 16, 1965, when a number of subjects were dealt with including: 1. A report on a meeting held in Washington, D.C., as provided for by Article VI of the Pink Salmon Protocol, 2. A review of success of spawning in the artificial channels at Weaver, Seton and Jones Creeks, 3. Approval of a second spawning channel proposed for Seton Creek, subject to satisfactory agreements being reached for land acquisition and conveyance of water, 4. Approval of construction of a low water level passage at Hell's Gate as soon as possible, 5. A report on the history of water temperatures in Horsefly River, which showed that in seventeen generations of the dominant sockeye run, dangerously high temperatures have occurred only four times, three of which were in recent cycle years, 6. A report showing the correlation of high water temperatures in Horsefly River with mortality of unspawned sockeye infected with columnaris disease and discussion of the relative merits and costs of different methods of controlling water temperatures in Horsefly River, 7. A detailed review of the sockeye and pink salmon runs for 1965.

On December 3, 1965, the Commission met with the Advisory Committee to discuss all aspects of the 1965 sockeye and pink salmon fishery in Convention waters.

The twentieth and final meeting of the year was held on December 16 and 17, 1965, with the first day devoted to general business. On December 17, 1965, the annual open meeting was held with the Advisory Committee and approximately 500 members of the fishing industry and interested government agencies. The characteristics of the 1965 fishing season, a summary of possible factors influencing the size of the 1966 sockeye run in Convention waters and the tentative proposals for regulation of this fishery were presented to the meeting for consideration by the Advisory Committee and their respective segments of the fishing industry.

1965 REGULATIONS

Recommendations for regulations governing the 1965 sockeye and pink salmon fishery in Convention waters were adopted at a meeting of the Commission held on January 29, 1965, and submitted to the two national governments for approval and to the State of Washington for implementation on February 4, 1965. The recommendations for Canadian Convention waters were implemented by the Government of Canada by an Order-in-Council dated April 29, 1965, and for United States Convention waters by an Order of the Director of the Washington State Department of Fisheries on April 30, 1965.

The recommendations of the Commission were as follows:

Canadian Convention Waters

"The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention between Canada and the United States of America for the protection, preservation and extension of the Sockeye Salmon Fisheries of the Fraser River System, signed at Washington on the 26th day of May, 1930, as amended by the Pink Salmon Protocol signed at Ottawa on the 28th day of December, 1956, hereby recommends that regulations to the following effect, in the interests of such fisheries, be adopted by Order-in-Council as amendments to the Special Fishery Regulations for British Columbia for the season of 1965 under authority of the Fisheries Act, namely:

1. (1) No person shall fish for sockeye or pink salmon in the waters of the southerly portion of District No. 3 embraced in Area 20 and that portion of Area 19 lying westerly of a straight line drawn across Juan de Fuca Strait joining William Head and Angeles Point through Race Rocks commencing at point of intersection with the international boundary line with purse seines:

(a) From the 27th day of June, 1965, to the 31st day of July, 1965, both dates inclusive; and

(b) From the 1st day of August, 1965, to the 14th day of August, 1965, both dates inclusive, except from six o'clock in the forenoon to six o'clock in the afternoon of Monday and Tuesday of each week; and

(c) From the 15th day of August, 1965, to the 4th day of September, 1965, both dates inclusive, except from six o'clock in the forenoon to six o'clock in the afternoon of Monday, Tuesday and Wednesday of each week; and

(d) From the 5th day of September, 1965, to the 18th day of September, 1965, both dates inclusive, except from seven o'clock in the forenoon to seven o'clock in the afternoon of Monday, Tuesday and Wednesday of each week.

(2) No person shall fish for sockeye or pink salmon in the waters described in subsection (1) of this section with gill nets:

(a) From the 27th day of June, 1965, to the 31st day of July, 1965, both dates inclusive; and

(b) From the 1st day of August, 1965, to the 14th day of August, 1965, both dates inclusive, except from

(i) six o'clock in the afternoon of Sunday to six o'clock in the forenoon of Monday; and

(ii) six o'clock in the afternoon of Monday to six o'clock in the forenoon of Tuesday of each week.

(c) From the 15th day of August, 1965, to the 4th day of September, 1965, both dates inclusive, except from

(i) six o'clock in the afternoon of Sunday to six o'clock in the forenoon of Monday; and

(ii) six o'clock in the afternoon of Monday to six o'clock in the forenoon of Tuesday; and

(iii) six o'clock in the afternoon of Tuesday to six o'clock in the forenoon of Wednesday of each week.

(d) From the 5th day of September, 1965, to the 18th day of September, 1965, both dates inclusive, except from

(i) seven o'clock in the afternoon of Sunday to seven o'clock in the forenoon of Monday; and

(ii) seven o'clock in the afternoon of Monday to seven o'clock in the forenoon of Tuesday; and

(iii) seven o'clock in the afternoon of Tuesday to seven o'clock in the forenoon of Wednesday of each week.

(3) No person shall fish for sockeye or pink salmon in the waters described in subsection (1) of this section except by angling or trolling for the purpose of personal consumption and not for sale or barter from the 13th day of August, 1965, to the 13th day of September, 1965, both dates inclusive, except from midnight Sunday to midnight Friday of each week.

2. No person shall fish for sockeye or pink salmon in the waters of the southerly portion of District No. 3 embraced in Areas 17 and 18 and that portion of Area 19 lying easterly of a straight line drawn across Juan de Fuca Strait joining William Head and Angeles Point through Race Rocks commencing at point of intersection with the international boundary line and in the waters of District No. 1 by means of nets:

(a) From the 27th day of June, 1965, to the 28th day of August, 1965, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Wednesday of each week; and

(b) From the 29th day of August, 1965, to the 11th day of September, 1965, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week; and

(c) From the 12th day of September, 1965, to the 18th day of September, 1965, both dates inclusive; and

(d) From the 19th day of September, 1965, to the 9th day of October, 1965, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week.

3. No person shall fish for sockeye or pink salmon except by angling or trolling for the purpose of personal consumption and not for sale or barter in the Convention waters of Canada, (the waters of Howe Sound excepted), lying easterly and inside of a straight line projected from Gower Point at the westerly entrance to Howe Sound to Thrasher Rock light, thence in a straight line to Salamanca Point on the southerly end of Galiano Island, thence in a straight line to East Point on Saturna Island, thence in a straight line towards Point Roberts light to the intersection with the international boundary line, thence following the international boundary line to its intersection with the mainland from the 22nd day of August, 1965, to the 9th day of October, 1965, both dates inclusive, except at the times that net fishing other than with spring salmon nets may be permitted within that area.

All times hereinbefore mentioned shall be Pacific Daylight Saving Time."

United States Convention Waters

"The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention between Canada and the United States of America for the protection, preservation and extension of the Sockeye Salmon Fisheries in the Fraser River System, signed at Washington on the 26th day of May, 1930, as

amended by the Pink Salmon Protocol signed at Ottawa on the 28th day of December, 1956, hereby recommends to the Director of Fisheries of the State of Washington, that regulations to the following effect in the interests of such fisheries, be adopted by him for the year 1965 by virtue of authority in him vested by Section 6 of Chapter 112 of the Laws of the State of Washington of 1949, namely:

1. (1) No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying westerly of a straight line drawn from Angeles Point in the State of Washington across Race Rocks to William Head in the Province of British Columbia with purse seines:

(a) From the 27th day of June, 1965, to the 31st day of July, 1965, both dates inclusive; and

(b) From the 1st day of August, 1965, to the 28th day of August, 1965, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday and Tuesday of each week; and

(c) From the 29th day of August, 1965, to the 18th day of September, 1965, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday, Tuesday and Wednesday of each week.

(2) No person shall fish for sockeye or pink salmon in the waters described in subsection (1) of this section with gill nets:

(a) From the 27th day of June, 1965, to the 31st day of July, 1965, both dates inclusive; and

(b) From the 1st day of August, 1965, to the 7th day of August, 1965, both dates inclusive, except from

(i) seven o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday; and

(ii) seven o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday; and

(c) From the 8th day of August, 1965, to the 28th day of August, 1965, both dates inclusive, except from

(i) seven o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday; and

(ii) seven o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday of each week; and

(d) From the 29th day of August, 1965, to the 18th day of September, 1965, both dates inclusive, except from

(i) seven o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday; and

(ii) seven o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday; and

(iii) seven o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday of each week.

(3) No person shall fish for sockeye or pink salmon in the waters described in subsection (1) of this section with commercial trolling gear from the 13th day of August, 1965, to the 13th day of September, 1965, both dates inclusive, except from midnight Sunday to midnight Friday of each week.

2. (1) No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying easterly of a straight line drawn from Angeles Point in the State of Washington across Race Rocks to William Head in the Province of British Columbia with purse seines or reef nets:

(a) From the 27th day of June, 1965, to the 28th day of August, 1965, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday and Tuesday of each week; and

(b) From the 29th day of August, 1965, to the 2nd day of October, 1965, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday, Tuesday and Wednesday of each week.

(2) No person shall fish for sockeye or pink salmon in the waters described in subsection (1) of this section with gill nets:

(a) From the 27th day of June, 1965, to the 7th day of August, 1965, both dates inclusive, except from

(i) seven o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday; and

(ii) seven o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday of each week; and

(b) From the 8th day of August, 1965, to the 28th day of August, 1965, both dates inclusive, except from

(i) seven o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday; and

(ii) seven o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday of each week; and

(c) From the 29th day of August, 1965, to the 2nd day of October, 1965, both dates inclusive, except from

(i) seven o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday; and

(ii) seven o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday; and

(iii) seven o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday of each week.

3. No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying westerly of a straight line drawn true south from the southeast tip of Point Roberts in the State of Washington (otherwise known as Lily Point) to the international boundary line from the 5th day of September, 1965, to the 18th day of September, 1965, both dates inclusive.

4. No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying westerly of a straight line drawn from the Iwersen dock on Point Roberts in the State of Washington to the flashing white light on Georgina Point at the entrance to Active Pass in the Province of British Columbia from the 19th day of September, 1965, to the 2nd day of October, 1965, both dates inclusive.

All times hereinbefore mentioned shall be Pacific Daylight Saving Time.

In making the above recommendations for regulatory control of sockeye and pink salmon fishing in the Convention waters of the United States of America for the year 1965, the Commission recognizes the need for the continued maintenance of certain preserves previously established by the Director of Fisheries of the State of Washington for the protection and preservation of other species of food fish."

Emergency Amendments

In order to provide for adequate racial escapements of Fraser River sockeye and pink salmon and for an equitable share of the season's catch by the fishermen of Canada and the United States, the approved regulations as detailed above were later amended on recommendation of the Commission. A detailed list of the regulatory amendments is as follows:

July 19, 1965—Because of the early timing of the Horsefly sockeye run and the established relationship between early arrival on the spawning grounds and pre-spawning mortality, 24 hours of additional fishing time, effective July 21, was approved in both United States and Canadian Convention waters lying easterly of the William Head-Angeles Point line, and the opening of fishing for the week commencing July 25 delayed until minimum escapement requirements had been met.

July 26, 1965—In the interest of increasing the escapement of current races of sockeye, Canadian Convention waters lying easterly of the William Head-Angeles Point line were not re-opened to fishing for the week commencing July 25 until noon of July 27, after which time 48 hours of fishing was permitted. In United States Convention waters lying easterly of the William Head-Angeles Point line, fishing was delayed until July 28 when two days of fishing was permitted.

July 29, 1965—In order to attain an equitable division of the allowable sockeye catch an extension of 24 hours until 12:00 noon July 30 was permitted in Canadian Convention waters lying easterly of the William Head-Angeles Point line, to be followed by an indefinite closure.

August 2, 1965—Because of the continued disparity in catch favoring United States fishermen, fishing time was increased by 24 hours, effective August 4, in Canadian Convention waters lying westerly of the William Head-Angeles Point line; easterly of this line, fishing was permitted from 6:00 p.m. August 2 until 6:00 p.m. August 4. In United States Convention waters only one day of fishing was permitted for the current week, effective August 4.

August 4, 1965—In the interest of providing an allowable harvest of the current sockeye run, United States Convention waters lying easterly of the William Head-Angeles Point line were opened for an additional day, effective August 5.

August 6, 1965—To maintain equity in the sockeye catch by the fishermen of the two countries, fishing in Canadian Convention waters lying easterly of the William Head-Angeles Point line was limited to one day for the week, effective August 10.

August 10, 1965—To obtain a proper harvest of available sockeye populations an additional 24 hours of fishing time was permitted in all Convention waters, effective August 11. To attain equitable division of the sockeye catch, fishing in Canadian Convention waters lying easterly of the William Head-Angeles Point line would be permitted for only 24 hours the following week, effective August 17.

August 20, 1965—In the interest of providing minimum escapement needs of the early run of Fraser River pink salmon, fishing in Canadian Convention waters lying westerly of the William Head-Angeles Point line was reduced to two days, effective August 25 and 26; easterly of this line, 24 hours of fishing was permitted on August 25 above the Brunswick Cannery-Oak Street Bridge line only. In all United States Convention waters, fishing was permitted on August 25 and 26 except in the waters lying northerly and westerly of the Iwersen dock-Active Pass line which were closed to all fishing.

August 27, 1965—In an effort to obtain minimum escapement needs and provide for division of the allowable catch of pink salmon, fishing in Canadian Convention waters was limited during the week commencing August 29 to 24 hours, effective August 30, in the Fraser River above the Brunswick Cannery-Oak Street Bridge line. During the week beginning September 5, fishing in Canadian Convention waters lying westerly of the William Head-Angeles Point line was limited to two days, effective September 7 and 8, and the area easterly of this line was closed except for spring salmon fishing as permitted by the Area Director of the Department of Fisheries of Canada. All United States Convention waters were closed until September 7, when two days of fishing were allowed except in the waters lying westerly of a line projected true south from Lily Point which were closed by the initial regulations.

September 8, 1965—Since a fair escapement of Fraser River pink salmon into Georgia Strait had been achieved and the run coming through Juan de Fuca Strait had declined markedly, 24 hours was added to the fishing time in Canadian Convention waters lying westerly of the William Head-Angeles Point line, effective September 9. The Commission relinquished regulatory control in this area, effective September 12. Fishing in all United States Convention waters, except those waters lying westerly of the Lily Point line, was also extended by 24 hours, effective September 9. Regulatory control of fishing in United States Convention waters lying westerly of the William Head-Angeles Point line was relinquished, effective September 12. During the week commencing September 12 fishing was permitted in all United States Convention waters for two days, effective September 13 and 14, except westerly of the Lily Point line and on the request of the Washington State Department of Fisheries, in the waters lying southerly of a line projected from Dungeness light to Smith Island light to Outer Lawson Reef light to Burrows Island light to Fidalgo Head.

September 10, 1965—In view of the very small catches of pink salmon in the West Beach area during the current week, the closure order of September 8 for this area was rescinded at the request of the Washington State Department of Fisheries.

September 16, 1965—Improvement in the pink salmon escapement made it possible to permit fishing for 24 hours, effective September 20, in Canadian Convention waters lying easterly of the William Head-Angeles Point line and westerly of the "Blue Line"; also on this date under regulation of the Department of Fisheries of Canada, fishing with large mesh nets was permitted in the Fraser River above the Brunswick Cannery-Oak Street Bridge line from 8:00 a.m. to 8:00 p.m. Regulatory control of United States Convention waters lying easterly of the Angeles Point-William Head line was relinquished, effective September 19, except in the area lying westerly and northerly of the Iwersen dock-Active Pass line which would remain closed.

September 22, 1965—In view of the delay in pink salmon proceeding up the Fraser River, fishing in Canadian Convention waters lying easterly of the William Head-Angeles Point line was closed until further notice.

September 27, 1965—To achieve division in the allowable catch, fishing was permitted in Canadian Convention waters lying easterly of the William Head-Angeles Point line for a period of 24 hours, effective September 29.

October 8, 1965—Since the numbers of sockeye and pink salmon remaining in the Fraser River area were relatively unimportant, the Commission relinquished regulatory control in all Canadian Convention waters lying easterly of the William Head-Angeles Point line, effective October 5, thus completing the Commission's regulatory obligations in Convention waters for the 1965 season.

SOCKEYE SALMON REPORT

The Fishery

The catch of 2,065,000 sockeye in 1965 by the fishermen of the two countries was within the expected estimates reported to the fishing industry in December, 1964. From 22,000,000 smolts leaving Stuart Lake produced by the 1961 escapement, only 4.5 per cent survived to return a run of 980,000 adults. In contrast, a total of 6,000,000 Horsefly smolts survived at a rate of 20 per cent and the largest adult run (1,200,000 fish) since 1917 returned in 1965. Without this large return to Horsefly the 1965 fishery would have been a great disappointment. However, the relative failure of the Stuart run and the favorable return to Horsefly River were not unexpected, since these possibilities had been considered by the Commission in formulating the 1965 fishing regulations and discussed with the industry in advance of the season.

If the rate of survival of the Stuart Lake smolts had been the same as that of the Horsefly smolts emigrating from Quesnel Lake, the 1965 catch of sockeye for each country would have been three times that actually recorded. Such an increase in catch would have substantially changed the current financial status of the fishing

industry. When large numbers of young fish are produced, poor survival is a disappointment to all concerned, and the cause or causes of both low and high survival rates of seaward migrant sockeye is under extensive investigation by Commission scientists. The successful prediction of Fraser River sockeye runs for a number of years, whether large or small, is evidence of the increased understanding of the survival dynamics of this species.

The 1965 sockeye run was early, as it was in the brood years of 1961 and 1953 (Tables III and IV). Early timing in the fishery results in an even earlier arrival of sockeye on the spawning grounds. For unknown reasons, these fish migrate up the Fraser River at a more rapid rate than is the case when the run is later, quite the reverse of what would appear to be the logical situation. Examination of previous catch records of Horsefly sockeye shows that the peak of four brood year runs ending in 1913 arrived in the lower Fraser River between August 3 and 8, while the arrival time was as early as July 28 for two of the four most recent cycle runs (1953 and 1965). The increased frequency of early timing in recent years (1953, 1961, 1963 and 1965) has not only complicated management of the fishery but also inhibited expansion of future runs since severe pre-spawning mortality has frequently been brought about by adverse relationship of early escapement with environmental conditions on the spawning ground. Regulatory adjustment of fishing was attempted again in 1965 to reduce the escapement of early arriving Horsefly fish and was successful in somewhat reducing the mortality of unspawned sockeye. Additional regulatory effort will be required in future years when runs arrive earlier than expected, but it should be pointed out that taking all of the early part of the run in the fishery has potential dangers. One of these involves an increased fishing effort and correspondingly greater catch before the exact size of the run is known. In addition, there is the possibility of overfishing a smaller run, like the one to Pitt River, which is peaking at the same time that the early arriving runs of the larger populations start to reach the fishing areas.

United States fishermen caught 1,026,000 Fraser River sockeye and Canadian fishermen 1,039,000 of the total of 2,065,000—sharing the catch on a basis of 49.68 per cent and 50.32 per cent, respectively (Tables I and II). The average weight of four-year-old sockeye was 5.72 pounds, slightly greater than the cycle average of 5.64 pounds.

The percentage of the Canadian sockeye catch taken in Juan de Fuca Strait was below average because the main run arrived about one week earlier than anticipated. The purse seine catch in the Straits area was the lowest in history for this cycle. This greatly reduced fishery on the 1965 sockeye run in Juan de Fuca Strait resulted in quite favorable catches for the Fraser River gill net fishermen, particularly above Pattullo Bridge, where a catch of 95,000 sockeye on August 2 was the largest daily sockeye catch for this area since 1946. While the total 1965 Canadian sockeye catch was down 23.4 per cent from that of the brood year, the Fraser River gill net catch increased 20.7 per cent.

The share of the cyclical sockeye catch taken by United States reef net fishermen continued to decline, dropping from 12.25 per cent in 1953 to 4.84 per cent in 1965. This decrease reflects the limitations imposed by the fixed nature of reef net gear and the increased efficiency of the mobile gill net and purse seine fishery.

The effect of increased gear efficiency was clearly evident again in 1965. In spite of reduction in fishing time and fleet size from that in 1961, the fishery harvested about 88 per cent of the Early Stuart sockeye run compared with approximately 78 per cent in 1961. When a run can be seriously overfished during a two day fishing week, with a reduced fleet, the problems involved in regulatory management become almost impossible to solve. Further evidence of the alarming capability of the current Convention waters fishery was observed in 1965 when on July 28 and 29, the United States catch of sockeye represented 42.4 per cent of the total season's catch. This was accomplished with a purse seine fleet 40.5 per cent smaller and a gill net fleet reduced by 19.7 per cent from those on a comparable date in 1961. Under such conditions, it is obvious that the Commission cannot formulate rigid pre-season fishing schedules without seriously endangering future sockeye runs and the required equitable catch division between fishermen of the two countries.

Escapement

The 1965 sockeye run to Convention waters totalled 3,031,243 fish, of which 2,065,313 were taken by the commercial fishery (Table II), 120,512 were caught in the Indian fishery (Table V) and 845,418 sockeye were recorded on the spawning grounds (Table VI). The net escapement represented 27.89 per cent of the total run and a decline of 32.53 per cent from the previous cycle escapement in 1961.

Several examples of the effects of changed gear efficiency on the maintenance of proper catch-escapement ratios were apparent in 1965. Even though both fleet size and fishing time were reduced, the gross escapement of Early Stuart sockeye dropped from 22 per cent of the run in the brood year to approximately 12 per cent in 1965. Only 23,045 Early Stuart sockeye reached the spawning grounds, hence little if any fishing can be permitted on this dominant cycle run when it returns in 1969. During the peak of the important Horsefly-Late Stuart run, the capture in two days of 42 per cent of the entire United States season's catch necessitated several days closure and adjustment in fishing time to provide for a similar catch by Canadian fishermen in the Fraser River and an adequate escapement. The United States fishermen became quite aroused at the time since they firmly believed that an excessive escapement was being permitted at their expense. The fact that a decline of 32.53 per cent occurred in the total escapement, in spite of the severe restrictions, could not prevent the highly critical feelings prevailing at that time since the fishermen had no way of knowing that their fishing efficiency had changed until complete records could be made available to them at the end of the season.

Migratory conditions for the escapement of all races were favorable since periods of high water and slides did not occur as they did in 1964. Individual escapements were early in arriving on most spawning grounds lying above Hell's Gate because of early arrival of the runs in the fishery. Water temperatures were high and mortality of unspawnd fish occurred in some areas. A 46.8 per cent pre-spawning mortality of the total escapement was recorded in the Horsefly River. It was anticipated that the 1965 Horsefly run would encounter warm water on the spawning ground, as it did in 1961, and an extra day's fishing was permitted at the beginning of the run, which eliminated the escapement for one week. An attempt was also made, through regulatory action, to reduce the numerical escape-

ment to both the Horsefly River and Late Stuart spawning grounds. Although a reduction in total escapement was accomplished, the similar timing of these two runs produced escapements in proportion to the size of the separate populations. A total of 581,000 sockeye escaped to the two areas, down considerably from the 713,000 recorded in 1961, but the escapement of 359,232 to Horsefly River represented an increase over the 295,705 spawners recorded in the brood year. While these regulatory measures did not alleviate the density of Horsefly River spawners as a contributing cause for pre-spawning mortality of sockeye, the death of 46.8 per cent of the escapement was a considerable improvement over the 62.0 per cent recorded in 1961. Intensive investigations into the direct cause of death of unspawned Horsefly sockeye and of the necessary means of prevention are now nearing completion.

It is believed that the effective total sockeye escapement was adequate to produce a substantial run in 1969 and one considerably larger than occurred in 1965, if normal conditions for survival prevail. Escapements of relatively minor runs to Cultus Lake, Pitt River, Upper Nadina and Nithi Rivers were disappointing in 1965. The escapement of the once large run to Early Stuart streams was too small, as explained before, to return a run similar to that of recent cycle years.

The continuing increase in dominant runs of sockeye to Horsefly River has been a source of considerable satisfaction, in spite of the frequent occurrence of warm water temperatures during spawning and the related excessive mortality of unspawned fish. When several hydroelectric dams were proposed for the Quesnel River in 1951, the optimism expressed by fisheries agencies regarding the expected rehabilitation of the historic Quesnel run, supported mainly by Horsefly River, was the subject of considerable doubt. The following record justifies the position then taken by fisheries agencies concerning this proposal which fortunately did not materialize.

Recent Biography of the Dominant Horsefly Sockeye Run

Brood Year	*Escapement*	*Pre-Spawning Mortality*	*Total Run Produced*
1941	1,065	—	—
1945*	3,000	—	—
1949	20,000	12%	426,000
1953	105,218	30%	540,000
1957	226,378	0%	880,000
1961	295,705	62%	1,200,000
1965	359,232	47%	?

* Construction of Hell's Gate Fishways.

Rehabilitation

The continuing deterioration of certain sockeye salmon spawning grounds of the Fraser River watershed necessitates a thorough study of the physical factors affecting survival of eggs, alevins and fry. Development of artificial aids to offset stream damage or to increase salmon production cannot proceed on theory alone. Suitable environment for ultimate survival must be defined and maintained. The

many factors involved are under intensive investigation as indicated by certain of the publications listed at the end of this report. Similar information apparently is required for predicting adult survival rates and for protecting salmon populations from the effects of dams, artificial temperature changes, pollution, log driving, water diversion or any other activity related to a developing civilization. There have been too many relationships indicated between adult survival of Fraser River sockeye and pink salmon and freshwater environment to ignore the condition of emerging fry as a potentially important factor determining ultimate survival.

The fish hatchery, which is being used so successfully in the northwest United States to increase production of certain races of chinook and coho salmon, has not been proven successful in the case of other races of chinooks or other species of salmon. Certainly, it was not successful in increasing production of Fraser River sockeye, and for that reason, hatchery operation in the Fraser system was discontinued by the Canadian Government in 1937.

In an attempt to produce an increased number of sockeye fry by artificial means, having a potential survival rate equivalent to that of naturally produced fry, the Commission undertook both a laboratory and field study of natural and artificial propagation. As an adjunct to this study, an experimental hatchery was constructed on Upper Pitt River watershed where the sockeye run appears in danger of extermination from erosion and unstable spawning grounds.

During the first three years of operation of the experimental hatchery (1960, 1961, 1962), various environmental changes were introduced, such as the elimination of light during incubation. Regardless of these changes, the sockeye fry produced from the hatchery were inferior in several respects to naturally produced fry. Experimental work at both the hatchery and the Commission's Sweltzer Creek Laboratory suggested that subsequent development of the "eyed egg", originally spawned artificially and incubated in the hatchery, should proceed in a porous gravel medium to eliminate adverse differences between hatchery and wild fry.

An artificial *incubation* area, designed and constructed in time for the 1963 Pitt River sockeye run, was described and illustrated in the Annual Report of the Commission for 1963. During the three years (1963, 1964, and 1965) this incubation channel has been in operation, the "eyed egg" to fry survival rate has varied from 76 to 89 per cent. In spite of these high rates of survival, the resulting fry appear equivalent in every respect to those produced naturally in Pitt River, where measured egg-to-fry survival rates have been as low as 4 per cent. It would appear that sockeye fry are now being produced of the quality and abundance necessary to sustain and increase this run. Once this is finally substantiated when the five-year-old adult runs begin returning in 1968, the combination of hatchery and incubation channel should become competitive with the artificial spawning channel as an aid to increased sockeye production in the Fraser River. Although involving higher operating costs, the incubation channel has the advantage of requiring considerably less water than the spawning channel. This allows for more delicate thermal controls and greater economy in capital construction costs.

While the fry produced by the experimental hatchery in 1960, 1961 and 1962 were considered vastly inferior to wild fry, some indication of their survival to adult fish is reflected in the size of the run returning to the hatchery location at

FIGURE 1—Weaver Creek Artificial Spawning Channel completed September 1965. Weaver Creek is in the foreground. The silt settling basin is in the upper left and the outlet structure at the extreme right. Alder trees have been planted throughout the channel to provide natural cover as soon as possible.

Seven Mile Creek. In 1965, 2400 adult sockeye, or 34.38 per cent of the total Upper Pitt River escapement, were observed in Seven Mile Creek. This percentage is by far the highest recorded and compares with a 20 year average of 8.56 per cent. Since the 1965 run totalled only 6,981 sockeye and eggs were taken from random fish, unrestrained by racks or obstructions, only 2,132,500 eggs were collected. Mortality to the eyed stage during development in the hatchery was 6.8 per cent, leaving 1,986,500 eyed eggs to be planted in the incubation channel. Planting was completed by November 17 and subsequent sampling revealed that high survival rates were being maintained, as in previous years of operation.

An artificial *spawning* channel, 9600 feet long, 20 feet wide and designed to accommodate 10,000 female sockeye, was completed adjacent to Weaver Creek in time for the October 1965 spawning escapement. Logging of the Weaver Creek watershed had resulted in frequent extremely low stream flows during the first arrivals of adult fish, later followed by gravel eroding floods, and had placed the future of the Weaver Creek sockeye run in jeopardy. In addition, increased numbers of sockeye fry were required to utilize the available rearing capacity of Harrison Lake.

A total of 5,792 salmon of all species spawned effectively in the new Weaver Creek channel in 1965. The following table shows the composition of this spawning population by species and sex.

Species	*Males*	*Females*	*Jacks*	*Per Cent Spawned (Females Only)*
Sockeye	1,417	2,986	38	96.15
Pink	18	32	0	98.40
Chum	689	497	0	98.90
Coho	57	59	4	79.70

It was interesting to note that the adult sockeye initially appeared reluctant to adapt to the unseasoned channel and it was necessary to take action to prevent their leaving the area. Nevertheless, spawning and fertilization success proved to be good and limited sampling during the incubation period suggested a high egg-to-fry survival rate of the 14,322,000 eggs deposited.

The fry emerging from Weaver Creek channel in the spring of 1966 will be enumerated by photography to prevent physical handling of fish. Migrating fry will be diverted through a narrow sluiceway, painted white, at the lower portion of the channel. It is believed that periodic photographs associated with space and velocity data will permit estimation, within practical limits of accuracy, of the total number leaving the channel. This method has proven quite accurate for enumerating the fry population at Chilko Lake over a number of years, although in this case fry move upstream instead of downstream as in the Weaver channel.

It is very important to the future of certain Fraser River sockeye populations that either or both the artificial incubation and spawning channel prove successful in terms of returning adult runs. At the moment, these are the only known artificial aids which have the potential to substitute for lost or deteriorating spawning grounds, or to increase fry production when unused lake rearing potential is available.

PINK SALMON REPORT

The Fishery

The 1965 Fraser River pink salmon run was predicted in December 1964 to be approximately 6,500,000 on the basis of the number of fry available from 1963 brood year spawning and the favorable survival conditions encountered prior to their departure from inland marine areas for the high seas. The methods used to calculate abundance of fry were revised during 1965 and it was subsequently found that fry production from the 1963 spawning had increased by 97.9 per cent over that of the brood year. Instead of the forecast return of 6,500,000 adult pink salmon, fry were available to produce a run of approximately 9,000,000 in 1965. These findings were verified by Commission personnel who estimated through visual observations and seining that fingerling abundance in the Gulf Islands and San Juan Islands areas was about twice that of the previous brood, which had produced an adult run of approximately 4,500,000 fish.

In spite of this, the 1965 Fraser River pink salmon run was only slightly better than the poor return in 1961 and totalled approximately 2,000,000 fish. This was the first time on record that such a small run occurred when environmental conditions for young fish in the Gulf of Georgia were favorable. However, it should be noted that the return of pink salmon along the entire Pacific Coast in 1965 was far below the expected level of abundance. What caused this general decline in abundance of pink salmon has not been assessed to date by any of the fisheries agencies involved.

The first indication that the 1965 Fraser run was destined to be much below the predicted level came from evaluation of early season landings by both the Canadian and United States troll fishery. These landings were down considerably from those of the same period in the brood year, later shown by the fact that the Convention waters troll catch in 1965 totalled only 151,779 pink salmon compared with 939,462 fish in 1963 (Table X). In addition to the small troll fleet catch throughout the entire season, the average weight of Fraser River pinks in 1965 was 6.25 pounds, as compared with the much smaller fish (5.00 pounds) returning in 1963. Examination of catch records and size of pink salmon from 1935 to 1965 has shown that a strong inverse relationship exists between magnitude of the catch in Convention waters and weight of individual pink salmon.

In contrast to the 8,599,520 pink salmon caught in 1963, the 1965 catch in Convention waters totalled only 1,150,847 (Table XI). The United States share of the catch was 558,380 compared to 592,467 for Canadian fishermen. The United States troll catch formed the highest percentage (13.94 per cent) of the total United States catch on record. The Canadian Juan de Fuca Strait purse seine catch in 1965 was only slightly better than the poor catch of 313,636 (Table X) recorded in 1961.

Populations other than those destined for the Fraser River which migrate through Convention waters were reduced even more than the Fraser run, which dropped to 44.5 per cent of the brood year total. The 1965 season's catch at West Beach, reflecting the abundance of pink salmon of United States origin, was only

71,776 compared with a record catch of 2,179,821 in 1963. The catch of Canada non-Fraser pink salmon, which migrate through northern Puget Sound before August 15, was only 53,787 in 1965 as compared with 485,073 in 1963.

An eleven day closure in United States Convention waters was imposed from August 27 to September 6 for the purpose of ensuring that a minimum Fraser River escapement would be obtained. It is obvious that this closure was entirely justified in order to maintain a fair spawning potential for the 1967 season.

Details of the 1965 daily catch by both United States and Canadian fishermen are shown in Tables XII and XIII. Comparative estimates of contributions by stocks to the pink salmon catch in Convention waters during 1963 and 1965 are shown in the table on the following page.

Escapement

The total escapement of pink salmon to the Fraser River in 1965 was 1,191,000 out of a total run available in Convention waters estimated at 2,000,000 fish, or approximately 59.6 per cent of the run. The early run escapement of 917,736 fish was down only slightly from that of the brood year, however this escapement was larger than that recorded in either 1959 or 1961 (Table XIV). The magnitude of the 1965 early run escapement was still far below a satisfactory level in relation to the total area available for spawning. Evidence that the Fraser system is capable of supporting spawning populations far in excess of those allowed in recent years can be realized from an examination of fry production data from the 1961 and 1963 escapements. The 1961 escapement of 1,094,000 adults produced a total of 143,600,000 fry (131 fry per spawner) whereas the increased escapement of 1,953,000 in 1963 produced fry at an even higher rate (145 fry per spawner) resulting in a total emergence of 284,200,000 fry.

One of the interesting features of the early run escapement was the continued substantial escapement to several areas above Hell's Gate. Escapements into Seton Creek and the Thompson River were similar to those recorded in 1963. The Bridge River escapement increased to 23,657 compared with only 6,422 fish in 1963. The spread of pink salmon extended up the Thompson River to the South Thompson River at Chase, B. C., and into Adams River, as well as up the Fraser River to Quesnel River. Several thousand pink salmon were estimated to have spawned in Quesnel River, approximately 50 were reported in Hawks Creek near Williams Lake, and a few were observed in the Chilcotin River. Fry emergence will be investigated in the spring of 1966 to assess the relative success of this spawning.

The late run escapement of only 273,387 was below the minimum desired level, being the smallest escapement since 1959 and down substantially from the 980,453 recorded in 1963. The number of fish spawning in Harrison River in 1965 is considered to have been the smallest in many years; certainly it was less than any run recorded since spawning ground enumeration was initiated in 1957. The failure of the Harrison River run was surprising, as studies in 1964 had shown that fry abundance in the Harrison system was 3.4 times the production from the Chilliwack-Vedder River system, yet the number of spawners returning to the latter area in 1965 was 2.9 times greater than to the Harrison River.

CALCULATED CATCHES AND PERCENTAGE REMOVAL FROM THE PINK SALMON RUNS ENTERING THE CONVENTION AREA IN 1963 AND 1965

	Source of Run							
	United States		*Fraser*		*Canada Non-Fraser*		*Total*	
	1963	1965	1963	1965	1963	1965	1963	1965
TOTAL ENTERING CONVENTION AREA	10,330,074	1,344,350	4,520,225	1,912,367	1,317,977	123,706	16,168,276	3,380,423
CATCH IN CANADIAN CONVENTION WATERS								
Westerly of William Head	2,579,799	244,722	1,021,940	222,567	114,045	15,169	3,715,784	482,458
Easterly of William Head	—	—	411,999	107,009	45,505	3,000	457,504	110,009
Total	2,579,799	244,722	1,433,939	329,576	159,550	18,169	4,173,288	592,467
Per Cent Removal	25.0	18.2	31.7	17.2				
CATCH IN UNITED STATES CONVENTION WATERS	2,790,891	115,812	1,133,286	390,972	502,055	51,596	4,426,232	558,380
Per Cent Removal	27.0	8.6	25.1	20.4				
TOTAL CATCH IN CONVENTION AREA	5,370,690	360,534	2,567,225	720,548	661,605	69,765	8,599,520	1,150,847
Per Cent Removal	52.0	26.8	56.8	37.7				

The Seton Creek artificial spawning channel was in operation for the third cycle year and 7,000 pink salmon were allowed to enter the channel before the gates were closed. On the basis of fry production from the 1961 and 1963 brood years, it is anticipated that the most favorable production will be achieved from this escapement of 7,000 spawners since in 1961, 6,711 pink salmon produced 3,592,000 fry and in 1963, 14,106 spawners produced only 3,480,325 fry.

Spawning conditions for all escapements were considered excellent. Both the main Fraser and Thompson Rivers were low during spawning and loss due to exposure during the winter low flows should have been minimal. Water temperatures were favorable and the success of spawning was excellent. At the end of the year no damaging floods had occurred in any of the pink salmon spawning areas.

WATERSHED PROTECTION

Improvement of fish passage facilities and numerous projects for extending and protecting the existing sockeye and pink salmon spawning areas in the Fraser watershed formed major aspects of watershed protection during the past year. Effects of certain climatic factors were also studied, as they relate to production of salmon in various areas. In addition, continued discussion and research regarding water quality and pollution were subjects of major importance.

Two projects to improve the passage for sockeye salmon in the Fraser Canyon were completed early in 1965 before the spring freshet. The first, a left bank upper level fishway at Hell's Gate, was constructed to provide passage over the range of river levels from gauge 70 to 92, encompassing the highest levels that have occurred during the period of adult sockeye migration. This structure was considered necessary to provide passage for the important Early Stuart sockeye run. At Yale Rapids, three concrete baffles were placed in the right bank rock cut to improve the hydraulic characteristics in this channel.

Further examination of fish passage conditions at Hell's Gate, at river levels below the lower operating limit (gauge 18) of the existing fishways, disclosed the desirability of extending this capacity down to gauge 10. A hydraulic model study of the left bank showed that passage could be increased to the desired capacity of 250,000 sockeye and pink salmon per day by constructing a series of sloping baffles along the river bank outside the present fishway. Plans were prepared and it is expected that the structure will be completed before the end of March, 1966, preventing recurrence of the delay of sockeye at low water levels that occurred in 1946.

Prior to the 1965 spring freshet, the Chilcotin River was surveyed by aerial photography from Farwell Canyon to the Fraser River, to ascertain if any gross changes in the character of the river had resulted from the severe slide in 1964. Ground surveys were also carried out at the slide, both before and after the freshet. It was found that no obstructions to salmon migration had been created and although it may take several years for a stable bed to be established, the river was eroding slowly through the slide material toward the original stream gradient.

The pink salmon spawning grounds in Seton Creek, including the spawning channel completed in 1961, are now fully utilized. Since increased escapements to Seton Creek may be anticipated with expansion of the early pink salmon run,

methods of providing additional spawning area were investigated. On the basis of these studies, the Commission recommended addition of a second spawning channel with capacity for 21,000 spawners, and it is anticipated that construction will be completed before the end of 1966.

The Weaver Creek spawning channel for sockeye salmon was completed in 1965, in time for the 1965 run of fish to utilize this new spawning area. Details of the operation of this channel are presented in the section on Rehabilitation. Investigation of methods to increase production by the small Late Nadina sockeye run were also completed, and although plans for a spawning channel have been prepared, construction has been delayed temporarily until the construction work factor eases in northern British Columbia.

Surveys were made at Gates Creek, tributary to Anderson Lake, to determine means of compensating for the apparent loss of spawning ground in the lower section of this stream. Plans for improvement will include possible expansion of the available spawning area to utilize the potential rearing capacity of Anderson and Seton Lakes. Preliminary studies for increasing production of sockeye and pink salmon were made in a number of other river systems where the present spawning grounds are limited, unstable, suffer from adverse environmental conditions, or where the available lake rearing area is not yet fully utilized. Basic data required for planning such projects are being accumulated, and availability of land is being investigated.

Further investigations related to salmon spawning areas were carried out in co-operation with the Departments of Fisheries and Public Works of Canada. A survey was made of the rapids section of Harrison River to determine the effects of dredging on river levels over sockeye and pink salmon spawning grounds at low discharge. Compilation of data and preparation of maps have been completed and results of this study should be known prior to the 1966 dredging season.

During the winter of 1964-65 observations were made in several salmon spawning streams throughout the Fraser watershed to learn more about ice conditions at the spawning grounds. It was found that frazil ice was prevalent in most spawning areas, with the exception of those located immediately downstream from lakes. In many streams, frazil ice accumulated and formed barriers which diverted the stream from its channel, thereby exposing eggs deposited in the affected portions of the stream. It is believed that these ice conditions may significantly affect the productive capability of certain spawning grounds, especially when alternating warming and cooling periods occur in areas which normally remain frozen over during the entire winter season.

Collection of temperature and discharge data was continued in 1965, for use in conjunction with detailed studies of the means to control water temperature in Horsefly River. Tests conducted at an experimental site adjacent to the river showed that pre-spawning mortality of Horsefly sockeye associated with high water temperatures could be almost eliminated by a reduction in water temperature. A comprehensive recommendation for remedial action will be submitted to the governments during 1966.

A temperature problem also exists for sockeye spawning in the Raft River. However, exploratory drilling for a ground water supply of cold water adjacent to this stream, conducted early in 1965, produced negative results. Investigation of other means of providing temperature control in this river has not been favorable.

A proposal to drive logs down the Stellako River was submitted in 1965, but was opposed by the Commission and the Department of Fisheries of Canada as this stream is an important salmon spawning area. However, because of representations on behalf of the Company concerned, consideration was given to the immediate problem of the lack of alternate facilities for delivering logs to the sawmill. Because such facilities were not available, it was recommended that the log drive be permitted as an interim measure in 1965, subject to restrictions as to time of driving and procedures to be followed for removing jams and stranded logs. The log drive was carried out during June and July, and was well documented on film and by detailed studies of its effects on the salmon and trout spawning grounds. To supplement data collected during the drive, several experiments were conducted at the Commission's Sweltzer Creek Station to determine the effects of physical impact, bark, wood fiber and chemicals leached from wood on the survival of salmon and trout eggs and fry. Results of these studies will form the basis for a comprehensive report to be prepared early in 1966.

The Commission continued its program of monitoring water quality at a number of points in the Fraser River system. These data, in conjunction with data being collected by other agencies, will provide a background for assessment of future conditions in this river system.

Negotiations between the Department of Fisheries of Canada and the companies constructing pulp mills at Prince George and Kamloops reached agreement regarding details of various in-plant practices and waste treatment facilities, and procedures for monitoring effluent quality. The mill at Kamloops started production at part capacity late in 1965, but by the end of the year there had not been sufficient waste discharged to fill the treatment basin. The two mills under construction at Prince George will commence operations by about mid-1966. Agreement in principle concerning waste handling and treatment was also reached between the Department and a third mill to be built at Prince George.

Research on the long term effects of neutralized kraft pulp mill bleach plant effluent on salmon continued at the Sweltzer Creek Station. Findings to date have substantiated the earlier conclusions that long term tolerance of various salmon life stages would be much more critical than indicated by short term bioassays on fingerlings. This research will be continued to determine the amount and kind of waste treatment necessary for the protection of salmon runs. On the basis of current knowledge, waste treatment facilities required at the various mills under construction in the Fraser River system are adequate for salmon protection, but further research may indicate desirable modifications or improvements.

Technical discussions between the Department of Fisheries of Canada and a steel wire mill company in the New Westminster area established treatment requirements for the effluent from the proposed mill. Details of methods for achieving these requirements are to be submitted by the Company for approval by the Department. Commission staff also participated with the Department in technical discussions concerning seismic exploration in Georgia Strait, and regarding cathodic protection at the sea water intake of the Burrard Thermal Plant.

1965 PUBLICATIONS

1. Annual Report of the International Pacific Salmon Fisheries Commission for 1964.

2. Research Bulletin Number XVII.

   The Migration, Composition, Exploitation and Abundance of Odd-Year Pink Salmon Runs in and Adjacent to the Fraser River Convention Area by A. S. Hourston, E. H. Vernon and G. A. Holland. Published by authority of the Pink Salmon Co-ordinating Committee.

3. Research Bulletin Number XVIII.

   The Effect of Transported Stream Sediments on the Survival of Sockeye and Pink Salmon Eggs and Alevin by A. C. Cooper.

4. Progress Report Number 12.

   The Influence of Physical Factors on the Development and Weight of Sockeye Salmon Embryos and Alevins by E. L. Brannon.

5. Administrative Report (restricted circulation).

   An Examination of the Factors Affecting the Migration of Sockeye and Pink Salmon in the Fraser and Thompson Rivers at Low River Levels.

6. Administrative Report (restricted circulation).

   Fish Disease as a Possible Cause of Pre-Spawning Mortalities of Fraser River Sockeye by James W. Wood.

TABLE I
SOCKEYE CATCH BY GEAR

United States Convention Waters

Year	Purse Seines			Gill Nets			Reef Nets			Total Catch
	Units	Catch	Percentage	Units	Catch	Percentage	Units	Catch	Percentage	
1965	169	740,123	72.13	388	236,133	23.01	55	49,707	4.84	1,026,118
1961	273	823,956	59.76	574	471,464	34.20	77	81,826	5.94	1,378,392
1957	234	1,237,665	73.27	638	286,614	16.97	87	164,951	9.76	1,689,265
1953	247	1,355,734	66.70	322	427,836	21.05	96	248,867	12.25	2,032,437

Canadian Convention Waters

Year	Purse Seines			Gill Nets			Traps			Total Catch
	Units	Catch	Percentage	Units	Catch	Percentage	Units	Catch	Percentage	
1965	89	85,914	8.27	1,501	944,266	90.87	0	0	0	1,039,195
1961	101	352,883	26.00	1,550	991,972	73.10	0	0	0	1,357,099
1957	104	522,426	38.39	1,309	820,850	60.32	5	15,759	1.16	1,360,760
1953	66	600,449	30.14	1,482	1,331,823	66.85	4	60,071	3.01	1,992,343

NOTE: Gear counts represent the maximum number of units delivering sockeye on any single day.
Unlisted troll catches of sockeye included in figures for total catch.

Table II

CYCLIC LANDINGS AND PACKS OF SOCKEYE FROM CONVENTION WATERS

	United States	*Canada*	*Total*
1965			
Total Landings (No. Sockeye)	1,026,118	1,039,195	2,065,313
Share in Fish	49.68%	50.32%	
Total Pack (48 lb. Cases)	84,430	89,738*	174,168
Share in Pack	48.48%	51.52%	
1961			
Total Landings (No. Sockeye)	1,378,392	1,357,099	2,735,491
Share in Fish	50.39%	49.61%	
Total Pack (48 lb. Cases)	119,197	116,231	235,428
Share in Pack	50.63%	49.37%	
1946-1965			
Total Landings (No. Sockeye)	32,950,320	32,296,837	65,247,157
Share in Fish	50.50%	49.50%	
Total Pack (48 lb. Cases)	2,888,377	2,792,908	5,681,285
Share in Pack	50.84%	49.16%	
1965 *Cycle Catch*			
1965	1,026,118	1,039,195	2,065,313
1961	1,378,392	1,357,099	2,735,491
1957	1,689,265	1,360,760	3,050,025
1953	2,032,437	1,992,343	4,024,780
1949	1,056,792	1,020,799	2,077,591
1945	706,464	969,444	1,675,908
1941	1,558,554	2,116,723	3,675,277
1937	897,022	1,075,986	1,973,008
1933	1,724,127	726,309	2,450,436
1929	1,334,141	725,037	2,059,178
1925	1,375,012	453,704	1,828,716
1921	1,199,929	486,312	1,686,241
1917	5,005,609	1,877,792	6,883,401
1913	21,736,398	9,606,641	31,343,039
1909	13,664,988	7,261,486	20,926,474
1905	10,330,277	10,350,959	20,681,236
1901	13,694,032	12,065,999	25,760,031

*Includes 542 cases packed in Canada from sockeye caught in United States Convention waters.

TABLE III

DAILY CATCH OF SOCKEYE, 1953-1957-1961-1965 FROM UNITED STATES CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1953	1957	1961	1965	1953	1957	1961	1965	1953	1957	1961	1965
1	24,386	10,165					128,699		1,307			
2	32,371	11,833					75,733	3,137	1,050	7,288		
3	39,812	13,977	47,926					1,445	1,027	25,515		
4			43,037		53,277			52,146	2,944	19,653		
5			28,585	26,335	50,531	247,511		65,290				
6	48,620			21,773	24,955	135,265			1,104			
7	69,419				24,647				780		CLOSED	932
8	54,566	42,804							757			358
9	57,159	57,639						55,149	892	1,852		181
10	31,169	23,464	143,287		35,819		82,844	30,297	509	3,333		
11			89,786		31,244			14,893	604	4,583		
12				20,836	21,641	169,312				1,451		
13	15,334			15,456	18,034	121,946			423	5		62
14	26,643				16,328	71,364			331			16
15	33,817	39,662					18,748		339			0
16	35,230	37,687					5,241	13,584	228	109		0
17	21,961	33,138	49,754		18,173			8,584	637	610		
18			43,233		14,384				17	170	22	
19			34,815	43,747	16,544	49,619					10	
20				74,983	8,017	45,223			60		6	20
21	175,068			84,674	14,939	28,689	11,491		22			23
22	109,925	95,124				27,606	6,038		5			57
23	165,742	78,735							8	24		40
24		52,762	199,232		14,521				9	29		
25			117,345		8,796			7,728		8	11	
26			73,843		6,949	22,237	CLOSED	3,863			33	
27	213,804				7,891	16,538			1		10	43
28	147,109			262,812	6,569	12,724						9
29	77,777	63,287		172,566		7,420						10
30	90,768	61,061			2,574				11			0
31		46,297	161,484		2,860							
Totals	1,470,680	667,635	1,032,327	723,182	398,693	955,454	328,794	256,116	13,065	64,630	92	1,751
Troll and outside seine	31,396		750	104	38,496		380	46	60			1
Monthly Totals	1,502,076	667,635	1,033,077	723,286	437,189	955,454	329,174	256,162	13,125	64,630	92	1,752
June, Oct. and Nov. Totals									80,047	1,546	16,049	44,918
Season Totals									2,032,437	1,689,265	1,378,392	1,026,118

TABLE IV

DAILY CATCH OF SOCKEYE, 1953-1957-1961-1965 FROM CANADIAN CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1953	1957	1961	1965	1953	1957	1961	1965	1953	1957	1961	1965
1	33,417	19	STRIKE RELIEF FISHING			36,393	109,677		4,397			
2	36,323	274						206,017	4,038	9,419		
3	2,287	1,658	36,879		91,326			79,921	4,797	4,956		
4		1,157	7,930		54,086			29,092	246	3,328		
5				35,176	48,611	83,204				1,920	53	
6	72,602			8,184	38,493	138,428				1,619	18	
7	36,926				6,820	52,297			6,321			133
8	22,165	68							5,136			106
9	27,665						28,636	20,830	6,556	67		59
10	2,500	4,529	109,597		20,889		23,368	63,820	7,067	11,153		
11		67	27,730		60,670			24,820	89	6,060		
12			34,089	19,440	37,370	37,115				3,340	7	
13	28,227		46,966	5,750	36,956	104,138	52,261			1,833	4	27
14	16,936				19,232	81,215	18,609		32			10
15	21,295					85,221	21,972		14			9
16	24,817	31,184					7,407	9,770	14,700	2,753		11
17	4,809	17,143	86,946		31,843			26,163	8,126	4,224		
18		17,281	44,527		13,370			4,618	2	2,102		
19				73,372	10,734	24,722				763	2	
20	93,156			22,946	13,397	62,386				924	3	4,335
21	128,664			13,577	7,066	40,463	17,815				2	8
22	112,022	72,300				31,909	5,898					3
23	87,223	82,253										
24		53,025	217,241		10,945				CLOSED			
25		20,679	153,593		4,916			6,790		1		
26			98,121		2,929	25,088		1,481				
27	40,629			179,102	4,860	12,623					11	
28	249,362			69,415	1,024	9,799	5,630					18
29	130,898	13,254		76,955		1,836	1,831				1	3
30	140,486	83,664		10,080				4,562				3,182
31	7,932	75,599	179,254		6,869							
Totals	1,320,341	474,154	1,042,873	513,997	522,406	826,837	293,104	477,884	61,521	54,462	101	7,904
Troll and outside seine		662	4,976	6,687	474	1,001	2,363	2,183		37	4,236	50
Spring salmon gill nets									212		625	569
Monthly Totals	1,320,341	474,816	1,047,849	520,684	522,880	827,838	295,467	480,067	61,733	54,499	4,962	8,523
June, Oct. and Nov. Totals									87,389	3,607	8,821	29,921
Season Totals									1,992,343	1,360,760	1,357,099	1,039,195

Table V

THE INDIAN CATCHES OF SOCKEYE SALMON BY DISTRICTS AND THE VARIOUS AREAS WITHIN THESE DISTRICTS, 1961, 1965

	1961		1965	
District and Area	*Catch*	*No. of Fishermen**		*No. of Fishermen**
HARRISON-BIRKENHEAD				
Skookumchuck and Douglas	770	37	1,330	19
Birkenhead River and Lillooet Lake	4,590	10+	4,470	36
Harrison and Chehalis	1,200	25	1,100	46
TOTALS	6,560	72+	6,900	101
LOWER FRASER				
Coquitlam to Chilliwack	20,016	115+	18,010	82
Chilliwack to Hope	15,170	140	13,550	69
Vedder River and Vicinity	15,759	60	10,800	100
TOTALS	50,945	315+	42,360	251
CANYON				
Hope to Lytton	33,000		36,400	
TOTALS	33,000	120	36,400	184
LYTTON TO LILLOOET				
Lytton to Lillooet	5,600		4,800	
TOTALS	5,600	67	4,800	70
BRIDGE RIVER RAPIDS				
Rapids	8,400		7,200	
Pavillion	1,500		2,300	
TOTALS	9,900	135	9,500	140
CHILCOTIN				
Farwell Canyon	942		22	7
Hances Canyon	1,337		247	10
Alexis Creek	630		216	30
Siwash Bridge	963		342	32
Keighley Holes	0		131	4
TOTALS	3,872	60	958	83
UPPER FRASER				
Shelley	38		254	
Alkali and Canoe Creek	275		513	
Chimney Creek	1,555		2,899	
Soda Creek	550		1,025	
Alexandria	425		792	
Quesnel	400		746	
TOTALS	3,243	73	6,229	138
NECHAKO				
Nautley Reserve	4,136	19	2,250	17
Stella Reserve	1,881	16	1,705	19
TOTALS	6,017	35	3,955	36
STUART				
Fort St. James	11,163	47	3,958	37
Tachie, Pinchi and Trembleur Villages	5,888	55	3,685	68
TOTALS	17,051	102	7,643	105
THOMPSON				
Main Thompson River	835	89	1,100	90
North Thompson River	95	42	250	42
South Thompson River	410	102	475	103
TOTALS	1,340	233	1,825	235
GRAND TOTALS	137,528		120,570	

* Number of permits issued to Indians in district.
The Indian catch statistics detailed above are obtained principally from the Protection Officers of the Department of Fisheries of Canada. These officers control the taking of sockeye for food by the Indian population residing throughout the Fraser River watershed.

TABLE VI
SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1953, 1957, 1961, 1965

District and Streams	1965 Period of Peak Spawning	Estimated Number of Sockeye				Jacks	Sex Ratio	
		1953	1957	1961	1965		Males 4-5 yr.	Females 4-5 yr.
LOWER FRASER								
Cultus Lake	Nov. 24-30	13,000	20,647	15,428	2,532	77	832	1,623
Upper Pitt River	Sept. 7-10	18,693	12,338	11,162	6,981	15	3,515	3,451
Widgeon Slough	Nov. 1-7	1,518	1,200	1,293	275	0	113	162
HARRISON								
Big Silver Creek	Sept. 22-26	432	389	398	596	0	238	358
Harrison River	Nov. 10-20	21,328	3,812	42,778	15,034	0	7,239	7,795
Weaver Creek	Oct. 8-25	9,530	20,887	4,383	11,162	51	4,560	6,551
Misc. Streams	Sept. 22-26	86	——	11	50	0	20	30
LILLOOET								
Birkenhead River	Sept. 16-23	53,111	24,168	49,627	30,008	13,778	5,587	10,643
SETON-ANDERSON								
Gates Creek	Aug. 24-27	78	1,112	252	1,679	37	577	1,065
Portage Creek	Oct. 26-31	200	470	527	2,108	1,127	392	589
SOUTH THOMPSON								
Seymour River	Aug. 27-28	5,947	14,095	5,822	6,954	865	3,341	2,748
Scotch Creek	Aug. 23-30	1,364	2,354	598	1,910	0	1,074	836
Lower Adams River	Oct. 15-21	177,000	257,614	57,796	55,041	53,466	532	1,043
Little River	Oct. 18-24	32,118	34,964	8,253	3,236	3,038	50	98
South Thompson River	Oct. 20-24	12,614	14,645	254	192	120	37	35
Misc. Streams	——	——	——	——	1,022	730	117	175
NORTH THOMPSON								
Raft River	Aug. 30-Sept. 1	8,242	7,264	7,301	6,624	0	2,538	4,086
Barriere River	Aug 30-Sept. 7	——	38	335	104	0	52	52
North Thompson River	——	——	——	225	Present	——	——	——
CHILCOTIN								
Chilko River	Sept. 24-27	197,660	140,765	40,315	39,902	4,567	12,294	23,041
Taseko Lake	——	4,422	3,667	80	Present	——	——	——
QUESNEL								
Horsefly River	Aug. 29-Sept. 3	105,218	226,378	295,705	359,232	10	164,408	194,814
Mitchell River	Sept. 5-10	2,344	2,677	6,601	5,335	0	2,442	2,893
NECHAKO								
Endako River	——	605	110	0	2	0	1	1
Nadina River (Early)	Aug. 28-Sept. 1	38,574	30,000	18,885	3,884	0	1,840	2,044
(Late)	Sept. 18-23	——	29,146	17,544	11,293	0	5,658	5,635
Nithi River	Aug. 28-Sept. 2	1,208	1,186	146	34	0	17	17
Ormonde Creek	——	956	450	0	0	0	0	0
Stellako River	Sept. 27-30	45,057	38,922	47,241	39,418	33	18,301	21,084
STUART								
Early Runs								
Ankwil Creek	Aug. 6-10	5,913	8,285	18,468	2,806	0	957	1,849
Bivouac Creek	Aug. 2-6	8,994	9,464	997	401	0	252	149
Driftwood River	Aug. 8-12	8,655	45,567	81,617	4,221	0	1,850	2,371
Dust Creek	Aug. 5-8	16,891	14,827	10,870	1,584	0	649	935
Felix Creek	Aug. 2-6	805	7,081	3,082	1,404	0	508	896
15 Mile Creek	Aug. 6-10	794	511	922	74	0	26	48
5 Mile Creek	Aug. 6-10	2,632	3,821	731	40	0	14	26
Forfar Creek	Aug. 2-6	18,054	17,975	13,599	2,221	0	784	1,437
Forsythe Creek	Aug. 6-10	4,500	6,385	5,836	553	0	212	341
Frypan Creek	Aug. 6-10	4,566	3,890	10,595	275	0	90	185
Gluske Creek	Aug. 2-6	16,074	21,899	5,652	2,200	0	859	1,341
Kynoch Creek	Aug. 2-6	16,676	13,473	16,170	2,885	0	1,231	1,654
Leo Creek	Aug. 2-6	6,361	10,620	1,624	121	0	44	77
Narrows Creek	Aug. 5-8	20,604	16,184	7,897	1,377	0	565	812
Paula Creek	Aug. 2-5	1,406	7,918	1,400	79	0	29	50
Rossette Creek	Aug. 2-6	6,355	7,087	4,993	1,165	0	422	743
Sakeniche River	Aug. 2-6	3,382	6,340	5,278	4	0	2	2
Sandpoint Creek	Aug. 2-6	2,092	20,914	3,523	706	0	262	444
Shale Creek	Aug. 6-10	3,809	1,606	2,392	79	0	28	51
25 Mile Creek	Aug. 5-8	2,167	724	1,663	229	0	80	149
Misc. Streams	Aug. 5-8	3,392	10,462	3,911	621	0	211	410
Late Runs								
Kazchek Creek	Sept. 8-12	7,903	19,582	15,676	3,292	0	1,623	1,669
Kuzkwa Creek	Sept. 14-18	3,686	50,006	39,245	10,000	0	4,369	5,631
Middle River	Sept. 12-18	235,572	332,098	177,516	139,186	0	55,804	83,382
Pinchi Creek	——	72	6,390	527	Present	——	——	——
Sakeniche River	Sept. 8-12	104	592	1,094	11	0	5	6
Tachie River	Sept. 14-20	107,506	118,252	177,047	62,469	15	22,418	40,036
NORTHEAST								
Upper Bowron River	——	13,517	12,069	7,460	2,660	1	1,197	1,462
TOTALS*		1,274,346	1,663,320	1,253,012	845,418	77,980	330,334	437,104

* Totals include small numbers of fish in small tributaries not listed in the table.

Table VII

DAILY CATCH OF SOCKEYE, 1950-1954-1958-1962 FROM UNITED STATES CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1950	1954	1958	1962	1950	1954	1958	1962	1950	1954	1958	1962
1		1,332			15,403			25,695		472,636	170,818	
2		6,000			20,880	30,780		16,883		446,988	326,983	
3					25,058	39,131				173,977	218,732	142
4						40,284	27,722				182,785	897
5		16,232				29,590	17,753				255,742	553
6		8,509			16,961	33,758	9,482	32,790		117,704	361,549	37,491
7		6,623			34,588			33,759	951	115,016	278,614	17,758
8		12,660			48,134			42,145	712	66,966	251,967	
9		8,676			41,470	91,674				71,330	270,105	
10					36,990	105,771			206	42,100	99,657	331
11						90,326	47,540		392	10,441	83,545	4,921
12		22,095				97,704	52,692		296	7,646	74,324	5,584
13		18,854			55,865	46,749	48,236	41,499	52	8,952	71,025	542
14		10,979			26,563			13,444	62	8,796	100,305	
15		10,248			18,115				40	10,409	44,837	
16		12,450			36,042	36,495				2,412	22,421	
17					52,889	72,456			898	1,229	80,171	
18						39,634			483	635	13,319	452
19		38,708				28,883			2,427	397	4,598	1,337
20		30,317			138,217	58,703	51,984	30,235	365	1,328		160
21		27,814	4,014		153,568		67,331	52,410	124	1,399		
22		24,719	6,199			91,515	62,943		67	1,239	22,260	
23		32,708	4,346	11,312	100,173	114,790				457	277,405	
24				12,930	131,748	83,238			12	308	6,769	
25				22,666	107,788	131,074	162,816		21	24	17,815	92
26				25,538		154,114	116,752		14	358		800
27		74,196			83,504	232,693	156,081		17	401		93
28		51,039	19,972		38,212		195,990		18	430		
29		43,155	10,697			406,321	218,385	183,264	11	159	42,564	
30		35,233	8,253	53,588	16,818	291,987	249,106			96	145,499	
31	14,286			33,591		359,793	173,652	52,971				
Totals	14,286	492,547	53,481	159,625	1,198,986	2,707,463	1,658,465	525,095	7,168	1,563,833	3,423,809	71,153
Troll and outside seine		3,566	26	388		32,348	1,092	426	453		109	23
Monthly Totals	14,286	496,113	53,507	160,013	1,198,986	2,739,811	1,659,557	525,521	7,621	1,563,833	3,423,918	71,176
June, Oct. and Nov. Totals										6,501	120,334	1,927
Season Totals									1,220,893	4,806,258	5,257,316	758,637

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Table VIII

DAILY CATCH OF SOCKEYE, 1950-1954-1958-1962 FROM CANADIAN CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1950	1954	1958	1962	1950	1954	1958	1962	1950	1954	1958	1962
1		2,203	831		25,874							
2		250	1,695	2,469	26,390	152,014			312	91,014	385,773	
3				6,116	30,775	72,397				152,294	466,479	
4						34,165	22,502		120	120,470	401,799	85,937
5		14,594				58,122	7,241		19,760		458,172	50,972
6		10,423			11,031	36,874	5,521	70,736	12,062	9,963	175,892	8,832
7		7,710	7,239		53,074			20,880	26,320	166,818		45,204
8		7,809	4,918		31,653				978	128,713		1,806
9		495	7,149	22,160	20,121	398			150	96,413	159,126	
10				11,310	21,189	3,731				101,374	199,470	
11				11,328	296	3,731	36,583		307	148,585	141,025	53,283
12		9,652				3,732	13,238		50		145,470	624
13		8,436			14,679	398	14,050	5,801	50		130,616	349
14		7,172	14,098		49,953				58	206,257		173
15		7,135	11,789		29,973			33,515	16	151,204		
16		1,783	16,213	12,460	32,366	108,415			16	180,631	2,486	
17				12,708	38,300	92,423				85	2,192	
18						80,050			16	569	1,974	
19		18,778				55,805			15	901	597	148
20		12,751			71,775	6,313	105,922	39,664	15	904	307	172
21		10,854	12,140		42,085		241,232	28,275	15	356		
22		15,976	6,642		29,217		284,595		10	606		
23		8,810	9,276	22,916	45,742	158,921			8	313	119	
24				7,351	52,525	235,021				307	74	
25					21,972	213,480	196,072		2	97	66	725
26		71,411				539,669	219,024		29,233	47,355	35	715
27		41,306			3,118	265,408	339,029		10,835	15,658	789	784
28		33,001	19,301		40,252		315,589	50,144	10,663	10,204		
29		33,306	9,497		19,577		195,690	26,674	4,980	19,086		
30		17,346	11,443	68 666	13,918	520,136		33,735		9,287	1.198	
31	31,679			18,324	7,737	48,441		25,720		4.435	391	
Totals	31,679	341,201	132,231	195,808	733,592	2,689,644	1,996,288	335,144	115,991	1,663,899	2,674,050	249,724
Troll and outside seine		3,356	350	790		10,283	3,373	4,417		103	1,131	291
Spring salmon gill nets								1,424			263	1,540
Monthly Totals	31.679	344,557	132,581	196,598	733,592	2,699,927	1,999,661	340,985	115,991	1,664,002	2,675,444	251.555
June, Oct. and Nov. Totals									13,207	13,977	433,931	47,261
Season Totals									894,469	4,722,463	5,241,617	836 399

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Table IX

SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1950, 1954, 1958, 1962

District and Streams	1962 *Period of Peak Spawning*	*Estimated Number of Sockeye* 1950	1954	1958	1962
LOWER FRASER					
Cultus Lake	Nov. 20-25	30,595	23,756	14,097	27,070
Upper Pitt River	Sept. 14-17	42,800	17,624	10,385	16,585
Widgeon Slough	Nov. 3-9	600	1,000	1,152	599
HARRISON					
Big Silver Creek	——	25	279	——	490
Harrison River	Nov. 10-15	33,860	28,800	14,701	8,162
Weaver Creek	Oct. 17-22	30,700	28,773	36,199	15,962
LILLOOET					
Birkenhead River	Sept. 22-28	72,767	41,201	33,055	52,146
SETON - ANDERSON					
Gates Creek	Sept. 8-12	——	47	81	1,046
Portage Creek	Oct. 25-Nov. 2	Few	3,505	4,803	12,034
SOUTH THOMPSON					
Seymour River	Sept. 2-4	12,000	26,258	78,575	58,104
Eagle River	Sept. 9-15	——	4	31	169
Scotch Creek	——	——	——	——	7
Anstey River	Sept. 15-20	——	——	——	77
Upper Adams River	Sept. 15-20	0	205	Present	85
Lower Adams River	Oct. 19-26	850,500	1,532,820	1,730,609	984,447
Little River	Oct. 19-26	376,000	427,850	409,480	115,881
South Thompson River	Oct. 19-24	41,500	87,611	123,864	19,152
Lower Shuswap River	Oct. 21-26	——	17,462	9,387	31,205
Middle Shuswap River	Oct. 22-27	0	0	499	457
Diverted Sockeye		0	0	1,006,177	0
NORTH THOMPSON					
Raft River	Aug. 31-Sept. 3	6,400	10,551	10,215	7,613
Barriere River	Aug. 31-Sept. 3	0	0	0	14
North Thompson River	Sept. 10-15	——	——	——	90
CHILCOTIN					
Chilko River	Sept. 25-28	29,800	36,534	137,081	92,467
Taseko Lake	Aug. 27-29	500	3,500	7,538	657
QUESNEL					
Horsefly River	Aug. 30-Sept. 4	400	279	1,784	1,001
Mitchell River	——	0	18	65	5
Little Horsefly River	Sept. 28-Oct. 3	——	——	14	72
NECHAKO					
Endako River	Aug. 31-Sept. 3	900	Present	522	236
Nadina River (Early)	Aug. 29-Sept. 4	1,950	2,219	804	450
Nadina River (Late)	Sept. 12-18				1,683
Nithi River	Sept. 1-3	125	46	5	25
Ormonde Creek	Aug. 28-Sept. 1	732	538	210	47
Stellako River	Sept. 29-Oct. 4	145,100	142,632	112,273	124,495
STUART					
Early Runs					
Ankwil Creek	Aug. 12-15	67	56	461	290
Driftwood River	Aug. 16-20	144	387	1,897	374
Dust Creek	Aug. 12-15	1,125	1,168	3,017	1,035
Felix Creek	Aug. 4-8	——	218	515	1,600
25 Mile Creek	Aug. 12-15	521	207	218	25
15 Mile Creek	Aug. 12-15	54	41	105	25
5 Mile Creek	Aug. 12-15	262	5	111	11
Forfar Creek	Aug. 6-10	10,259	5,702	8,715	4,464
Frypan Creek	Aug. 12-15	69	266	57	243
Gluske Creek	Aug. 6-10	11,007	5,292	1,642	1,841
Kynoch Creek	Aug. 6-10	24 644	14,088	9,477	8,672
Narrows Creek	Aug. 12-15	2,265	2,756	1,823	666
Paula Creek	Aug. 4-8	——	36	333	405
Rossette Creek	Aug. 6-10	6,260	3,836	3,735	4,887
Sakeniche River	Aug. 12-15	234	——	500	20
Sandpoint Creek	Aug. 12-15	——	508	875	243
Shale Creek	Aug. 12-15	638	279	657	306
Misc. Streams	Aug. 12-15	2,362	23	492	339
Late Runs					
Kazchek Creek	Sept. 15-20	243	83	369	77
Middle River	Sept. 14-18	2,600	3,927	7,762	11,706
Pinchi Creek	Oct. 8-15	——	5	850	142
Tachie River	Sept. 20-26	200	1,529	13,738	6,764
NORTHEAST					
Upper Bowron River	Aug. 20-25	16,266	10,774	14,871	6,292
TOTALS		1,756 474	2,484,698	3,815,826	1,622,960

TABLE X
PINK CATCH BY GEAR

United States Convention Waters

Year	Purse Seines			Gill Nets			Reef Nets			Troll		Total Catch
	Units	Catch	Percentage	Units	Catch	Percentage	Units	Catch	Percentage	Catch	Percentage	
1965	230	410,444	73.51	234	48,823	8.74	49	21,264	3.81	77,849	13.94	558,380
1963	357	3,454,287	78.04	262	382,424	8.64	69	89,768	2.03	499,753	11.29	4,426,232
1961	199	344,214	67.69	360	71,924	14.14	79	28,513	5.61	63,893	12.56	508,544
1959	317	1,913,555	78.83	446	227,643	9.38	81	110,416	4.55	175,921	7.24	2,427,535

Canadian Convention Waters

Year	Purse Seines			Gill Nets			Troll		Total Catch
	Units	Catch	Percentage	Units	Catch	Percentage	Catch	Percentage	
1965	89	336,478	56.79	1,268	182,059	30.73	73,930	12.48	592,467
1963	159	2,936,194	70.36	1,246	797,385	19.10	439,709	10.54	4,173,288
1961	82	313,636	57.53	1,116	142,518	26.14	88,974	16.33	545,128
1959	133	1,357,088	58.68	1,291	693,977	30.00	261,841	11.32	2,312,906

NOTE: Gear counts represent the maximum number of units delivering pinks on any single day

TABLE XI

LANDINGS AND PACKS OF PINK SALMON FROM CONVENTION WATERS

	United States	*Canada*	*Total*
1965			
Total Landings (No. of Pinks)	558,380	592,467	1,150,847
Share in Fish	48.52%	51.48%	
Total Pack (48 lb. Cases)	39,353	43,315*	82,668**
Share in Pack	47.60%	52.40%	
1965 Catch	558,380	592,467	1,150,847
1963	4,426,232	4,173,288	8,599,520
1961	508,544	545,128	1,053,672
1959	2,427,535	2,312,906	4,740,441
1957	2,777,366	2,634,720	5,412,086
1955	4,685,984	4,129,063	8,815,047
1953	4,951,429	4,142,117	9,093,546
1951	5,086,284	2,885,514	7,971,798
1949	6,235,400	3,189,662	9,425,062
1947	8,801,595	3,491,416	12,293,011
1945	5,458,890	1,279,849	6,738,739

* Includes 220 cases packed in Canada from pinks caught in United States Convention waters.

** 76,940 Pinks caught by United States fishermen and 88,236 pinks caught by Canadian fishermen were sold on the fresh and frozen market.

TABLE XII

DAILY CATCH OF PINKS, 1959-1961-1963-1965 FROM UNITED STATES CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1959	1961	1963	1965	1959	1961	1963	1965	1959	1961	1963	1965
1						34,070	52,307		187,274			
2						27,621	48,241	2,533	157,077		386,713	
3		34			6,110			1,312			215,316	
4		61			10,378			6,736			75,268	
5		38		84	13,181		68,013	15,117			61,129	
6				124	12,221		52,218					
7	CLOSED		CLOSED		13,229		40,441		108,145	CLOSED		108,690
8					9,036		30,906		153,233			68,470
9		494						14,502	133,600		103,803	27,983
10		398			10,105	64,389		11,818	132,028		193,448	
11					16,642			11,865			188,781	
12				674	17,634		102,743					
13				483	19,633		98,389					13,716
14							84,776					4,316
15						45,358			41,645			109
16		6,592				21,451		29,700	30,919			46
17		8,234			57,658			26,038	14,021			
18		12,592			41,664					4,023	91,403	
19				1,729	36,950		173,834			1,790	24,221	
20	1,063			2,504			166,400			1,265		6,185
21	1,533			2,272		72,620	181,808		8,427			2,036
22	1,127		7,831			51,641			8,204			2,099
23			19,156		10,524				4,195		26	2,402
24		25,288	17,490		316,210				1,134		41	
25		20,603	35,819		232,534	CLOSED		60,960		540	23	
26		18,595	27,844		59,823		427,506	46,508		463	14	
27	3,545		22,440		125,179		349,273			76		940
28	5,506			3,799			263 222		3,790			530
29	5,114		37,626	3,469			164,078		2,106			335
30	4,276		44,316						2,252		12,753	180
31		24,759	44 595		232,046							
Totals	22,164	117,688	257,117	15,138	1,240,757	317,150	2,304,155	227,089	988,050	8,157	1,352,939	238,037
Troll	40,259	20,449	133,114	21,986	126,019	40,671	327,235	53,630	6,545	1,683	20,550	1,832
Monthly Totals	62,423	138,137	390,231	37,124	1,366,776	357,821	2,631,390	280,719	994,595	9,840	1,373,489	239,869
June, Oct. and Nov. Totals									3,741	2,746	31,122	668
Season Totals									2,427,535	508,544	4,426,232	558,380

Table XIII

DAILY CATCH OF PINKS, 1959-1961-1963-1965 FROM CANADIAN CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1959	1961	1963	1965	1959	1961	1963	1965	1959	1961	1963	1965
1						14,821			117,313			
2								10,495	89,335		67,539	
3		1						12,117	99,848		182,611	
4		1			13		5,237	10,252	19,653		210,058	
5							31,344			3,335	178,872	
6				3			57,540		95,733	2,198		
7				2			67,174		52,704			17,544
8							775		92,362			10,086
9						18,773		23,992	131,918		24,161	5,416
10		4			25,687	22,031		24,346	88,337		131,138	
11		4			24,563			25,866	9,774		91,215	
12		6		10	24,718		77,691			936		
13		29		10	34,625	4,954	86,575			569		6,151
14						3,753	81,750		29,041			4,110
15						80,913	106,538		57,720			3,383
16						56,892		49,953	45,086		14,390	3,314
17		13,807			40,111			43,342	37,960		8,865	
18		8,909			29,604			40,776	1,169			
19				22	1,749		142,007			344		
20	1,603			49			113,020			260		52,695
21	1,807			182		15,144	125,864		20,122	431		718
22	2,880					39,029	372,486		17,566			383
23					201,421		187,652		36,721		71,976	
24		27,564			225,659				22,104			
25		22,427			146,148			81,419			5,651	
26		18,841			98,483		12,340	37,969		89	1,790	
27				353			419,589			30		317
28				147		5,480	243,875		93	22		163
29				198		12,061	229,443		202			32,671
30				70			220,827	5,307	63			
31		9,097			123,443							
Totals	6,290	100,690	0	1,046	976,224	273,851	2,581,727	365,834	1,064,824	8,214	988,266	136,951
Troll	27,542	26,208	100,316	14,990	179,795	34,659	214,245	51,148	44,467	20,038	106,578	7,378
Spring salmon gill nets									482	37,330	12,894	13,508
Monthly Totals	33,832	126,898	100,316	16,036	1,156,019	308,510	2,795,972	416,982	1,109,773	65,582	1,107,738	157,837
June, Oct. and Nov. Totals									13,282	44,138	169,262	1,612
Season Totals									2,312,906	545,128	4,173,288	592,467

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Strike July 12 - Aug. 4

Strike July 26 - Aug. 9

Table XIV

SUMMARY OF THE PINK SALMON ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS

District and Streams	1965 Period of Peak Spawning	Estimated Number of Pink Salmon 1959	1961	1963	1965
EARLY RUNS					
Lower Fraser					
Main Fraser	Sept. 28-Oct. 8	733,933	549,400	516,831	543,757
Harrison					
Chehalis River	Oct. 10-16	6,729	11,921	12,394	7,621
Fraser Canyon					
Coquihalla River	Oct. 3-8	16,038	7,316	14,971	3,845
Jones Creek	Oct. 3-10	2 604	5 038	3,500	3,000
Lorenzetti Creek	Oct. 3-8	991	218	13	8
Silver Creek	Oct. 3-8	1,914	705	590	88
Hunter Creek	Oct. 3-8	234	140	254	13
American Creek	Oct. 3-8	790	147	307	75
Spuzzum Creek	Oct. 3-8	2,111	263	364	31
Nahatlatch Creek	Oct. 1-7	216	244	369	424
Anderson Creek	Oct. 3-8	567	166	676	31
Stein River	Sept. 29-Oct. 5	62	83	231	125
Churn Creek	Oct. 10-15	0	0	81	5
Watson Bar Creek	——	——	——	411	——
Texas Creek	——	195	0	——	0
Yale Creek	——	510	31	31	0
Emory Creek	Oct. 3-8	728	22	36	5
Stoyoma Creek	——	42	0	——	0
Kawkawa Creek	Oct. 3-8	1,279	502	104	31
Ruby Creek	Oct. 3-8	528	448	614	221
Seton - Anderson					
Seton Creek	Oct. 12-20	14,887	58,717	121,424	95,046
Portage Creek	Oct. 10-15	52	1,550	8,013	5,931
Bridge River	Oct. 7-12	1,201	1,895	6,422	23,657
Thompson					
Thompson River	Oct. 1-10	86,342	69,179	282,240	230,417
Nicola River	Oct. 1-5	806	216	1,196	894
Bonaparte River	Oct. 1-5	3	8	1,706	1,750
Deadman River	Oct. 1-5	0	8	101	39
Nicoamen River	——	73	0	0	0
Total*		872,963	708,267	972,879	917,736
LATE RUNS					
Lower Fraser					
Stave River	Oct. 20-24	1,383	3,994	910	226
Whonnock Creek	Oct. 20-24	57	278	255	34
Silverdale Creek	Oct. 20-24	68	88	151	3
Kanaka Creek	Oct. 20-24	18	23	3	5
Harrison					
Harrison River	Oct. 16-23	110,311	186,137	645,476	69,213
Weaver Creek	Oct. 10-20	87	539	693	528
Chilliwack-Vedder					
Chilliwack-Vedder River	Oct. 13-21	91,517	188,066	313,167	188,843
Sweltzer Creek	Oct. 18-23	751	6,224	15,215	8,908
Slesse Creek	Oct. 10-15	317	55	1,578	1,524
Tamihi Creek	Oct. 10-15	——	——	101	13
Middle Creek	Oct. 10-15	528	434	2,904	3,531
Total*		205,037	385,838	980,453	273,387
Grand Total		1,078,000	1,094,105	1,953,332	1,191,123

* Totals include small numbers of fish in small tributaries not listed in the table.

Table XV

SUMMARY OF THE PINK SALMON ESCAPEMENTS TO UNITED STATES AND CANADIAN NON-FRASER RIVER SPAWNING AREAS*

United States Spawning Areas	1961	1963	1965
Nooksack	100,000	150,000	12,500
Skagit	400,000	1,190,000	150,000
Stillaguamish	125,000	640,000	185,000
Snohomish	50,000	275,000	185,000
Puyallup	10,000	10,000	25,000
Dosewallips	22,000	400,000	125,000
Duckabush	14,000	100,000	30,000
Dungeness	70,000	400,000	75,000
Elwha	8,000	40,000	15,000
Miscellaneous	9,000	19,000	10,400
Totaj	808,000	3,224,000	812,900

Canadian Non-Fraser Spawning Areas	1961	1963	1965
Jervis Inlet	259,000	211,000	43,275
Howe Sound	398,000	750,000	81,000
Burrard Inlet	76,000	200,500	35,250
Total	733,000	1,161,500	159,525

* These data were provided through the courtesy of the Washington State Department of Fisheries and the Department of Fisheries of Canada.

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